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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/774,417	02/10/2004	Yoshiki Nishibayashi	50212-559	1031

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McDermott, Will & Emery  
600 13th Street, N.W.  
Washington, DC 20005-3096

EXAMINER
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OLSEN, ALLAN W

ART UNIT	PAPER NUMBER
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1763

DATE MAILED: 07/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/774,417

Applicant(s)

NISHIBAYASHI ET AL.

Examiner

Allan Olsen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 02 May 2006.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935.C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,3 and 4 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 1,3 and 4 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 04 August 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☒ Certified copies of the priority documents have been received in Application No. 09/995,854.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 3/10/06.  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application (PTO-152)  
6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claims 1, 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over the paper by Shiomi, "High-Rate Reactive Ion Etching of Diamond and Fabrication of Porous Diamond for Field-Emission Cathode", in New Diamond, Vol. 13, No 4. pp 28-29, in view of US Patent 6,261,726 issued to Brooks et al. and further in view of US Patent 6,013,191 issued to Nasser-Faili et al. and further in view of (hereinafter, Shiomi, Brooks and Nasser-Faili, respectively).**

Shiomi teaches the reactive ion etching of a masked diamond surface. Shiomi teaches the mask comprises aluminum (page 2, line 17 of translation). Shiomi teaches that the diamond is etched by a plasma of 100% O<sub>2</sub>. Shiomi teaches that the angle of the sidewall can be controlled by adding CF<sub>4</sub> to the etchant. Shiomi teaches that vertical sidewalls can be obtained by adding a very small amount of CF<sub>4</sub>. Shiomi teaches using a CF<sub>4</sub> concentration as low as 0.125% page 5, line 2).

Shiomi does not teach supplying at least 0.45 W/cm<sup>2</sup> of power to the RIE process. Shiomi does not teach adding nitrogen to the etchant gas mixture.

Brooks teaches etching diamond with a mixture of O<sub>2</sub> and N<sub>2</sub> but Brooks does not teach using a fluorine containing etchant. See column 6, line 63.

Nasser-Faili teaches etching diamond with a plasma comprising  $O_2$  and  $NF_3$  while supplying  $1.5 \text{ W/cm}^2$  of power to the RIE process. See column 3, lines 42-48 and column 6, lines 23-25.

It would have been obvious to one skilled in the art to etch diamond with plasma comprising  $O_2$  and  $N_2$  and a fluorine-containing compound because Shiomi and Brooks teach that a plasma consisting of 100%  $O_2$  and a plasma consisting of an  $O_2$  and  $N_2$  mixture are functionally equivalent with respect to etching diamond. It would be obvious to add the fluorine to the  $O_2/N_2$  mixture of Brooks to gain the control over the etching profile as taught by Shiomi. The skilled artisan would have reasonable expectation of success in view of Nasser-Faili's teaching because Nasser-Faili demonstrates that etching diamond with a plasma comprising oxygen, fluorine and nitrogen with a low fluorine content, while supplying  $1.5 \text{ W/cm}^2$  of power, results in the formation of vertical structures similar to those obtained by Shiomi.

### ***Response to Arguments***

Applicant's arguments filed May 2, 2006 have been fully considered but they are not persuasive.

Applicant argues,

" motivation has not been established. Specifically, the Examiner asserted that Brooks et al. teach etching diamond with a mixture of oxygen and nitrogen, but no fluorine etchant. The Examiner runs to Nasser-Faili, et al. asserting the disclosure of etching diamond with oxygen and  $NF_3$ . The Examiner then somehow entwines the oxygen and nitrogen from one situation (Brooks et al.) with oxygen and  $NF_3$  from a different situation (Nasser-Faili, et al.), in an attempt to modify yet another situation (Shiomi) in arrive at the claimed method which employs oxygen, fluorine and nitrogen.

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Applicant's characterization of the rejection is not accurate. It is true that Nasser-Faili teaches etching diamond with  $O_2$  and  $NF_3$ , however, the examiner did not rely upon Nasser-Faili for a teaching pertaining to the use of nitrogen. An etchant comprising oxygen, fluorine and nitrogen was derived from the combination of Shiomi and Brooks alone. Shiomi teaches etching diamond with  $O_2$ . Shiomi teaches that the etching profile can be controlled by adding fluorine to an  $O_2$  etchant. Brooks teaches etching diamond with  $O_2$  and  $N_2$ . Hence the  $O_2$  of Shiomi and a  $O_2/N_2$  mixture of Brooks have been shown to be functionally equivalent with respect to etching diamond. When etching with a mixture of  $O_2$  and  $N_2$  it would have been obvious to one skilled in the art to add fluorine to derive the same control over etching profile that was obtained when fluorine was added to  $O_2$ . Contrary to applicant's assertion, this combination of Shiomi and Brooks does not rely on Nasser-Faili to arrive at an etchant comprising oxygen fluorine and nitrogen.

Regarding Nasser-Faili, applicant argues

**" Nasser-Faili et al. disclose polishing a diamond. In other words, Nasser-Faili et al. proceed in a direction completely opposite the claimed invention by disclosing a method for erasing a projection on diamond and making the diamond surface flat. It is inconceivable that one having ordinary skill in the art would have realistically looked to Nasser-Faili et al. for a method of forming a projection on the diamond when Nasser-Faili et al. in fact disclose erasing a projection on diamond. "**

The examiner notes that the polishing of Nasser-Faili relies upon a combination of isotropic etching and anisotropic etching. Nasser-Faili teaches that the anisotropic component the etching yields acicular projections like those of Shiomi. Additionally, the

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examiner notes that Nasser-Faili is relied upon for a teaching of power density.

Applicant claims a power density of at least  $0.45 \text{ W/cm}^2$ . Nasser-Faili teaches that using a higher power density leads to a more highly anisotropic etching result. As such Nasser-Faili teaches that one should use a high power density if one seeks to form projections like those of Shiomi. It is also noted that Nasser-Faili explicitly teaches the formation of "needle-like" structures (column 6, lines 56).

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 571-272-1441. The examiner can normally be reached on M, W and F: 1-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'Allan Olsen', with a stylized, cursive script.

Allan Olsen  
Primary Examiner  
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